HK 41: Accelerators and Instrumentation II

Time: Tuesday 16:30–19:00 Location: H-ZO 90

Group Report HK 41.1 Tu 16:30 H-ZO 90

The Transition Radiation Detector for ALICE at LHC — •Thomas Dietel for the ALICE-TRD-Collaboration — IKP Münster

The Transition Radiation Detector (TRD) for the ALICE experiment at the Large Hadron Collider (LHC) identifies electrons and performs online tracking in the challenging high multiplicity environment of heavy-ion collisions. A trigger decision based on the excellent position resolution and pion rejection capability can be provided within 6.5 microseconds after the interaction.

The TRD consists of 540 Xe gas-filled pad readout drift chambers with radiators, arranged in 18 super-modules in barrel geometry in the central part of the ALICE detector. The large active area of roughly 700 m^2 is covered by almost 1.2 million readout channels.

For a period of six months, four installed super-modules of the detector were commissioned with cosmic radiation. A trigger on cosmics generated by the TRD at level 1 was implemented and successfully operated in conjunction with the other subdetectors of the central barrel. We will report on the performance and current understanding of the detector based on these data.

HK 41.2 Tu 17:00 H-ZO 90

Alignment and tracking efficiency of the ALICE transition radiation detector — •Sebastian Huber — GSI, Planckstr.1, 64291 Darmstadt

We present a study of the tracking efficiency of the ALICE transition radiation detector (TRD) with the emphasis on its dependence on the chamber misalignment. For that purpose we analyze data simulated with the PYTHIA event generator and reconstructed with AliROOT. The efficiency is determined via the tracks reconstructed in the ALICE time projection chamber (TPC) and in the TRD. This will allow in the future to apply the same procedure to experimental data. The robust and versatile method used to determine the efficiency and the impact of misalignment on the data quality will be presented.

HK 41.3 Tu 17:15 H-ZO 90

Development of a transition radiation detector for a high counting rate environment — •Mariana Petris for the CBM-Collaboration — NIPNE, 407 Atomistilor St.P.O.B.MG-6, Bucharest - Magurele, Romania

The development of a Transition Radiation Detector (TRD) for a high counting rate environment, required by the next generation of experiments in hadron physics, as CBM experiment at the future facility FAIR, GSI-Darmstadt is a major technical challenge. The expected particle rates for CBM-TRD subdetector used for identification of high energy electrons and tracking of all charged particles, in particular at small polar angles, are up to 10^5 particles$\cdot$cm$^{-2}\cdot$s^{-1} for 10^7 interactions$\cdot$s^{-1} of minimum bias Au+Au collisions at 25 A*GeV.

A first TRD prototype with high granularity for a high counting rate environment was designed, built and successfully tested. In order to increase the conversion efficiency of the transition radiation in a single TRD layer a second prototype with a new configuration was built and tested. Results of the in-beam investigations of the rate capability and electrons - pions rejection factor as a function of number of layers are presented. The performance of this new type of TRD recommends this architecture of TRD as a solution for high counting rate environments and high pion efficiency TRD with reduced number of channels and material budget, at a given granularity.

Based on these results, for small polar angles region, a real size prototype is proposed.

HK 41.4 Tu 17:30 H-ZO 90

Optimization of the ALICE-TRD Software in the High Level Trigger — •Theodor Rascanu for the ALICE-HLT-Collaboration — Goethe Universität, Frankfurt, Germany

The High Level Trigger (HLT) system of the ALICE experiment at LHC has a multi-functional design. Though its main application is the triggering and selection of rare physics processes it plays a key role in the first online analysis of data and provides monitoring and quality assurance for the detectors. Due to the demands of an online system the HLT routines have to be both, precise and highly computing time efficient. The HLT has to instantly process a vast amount of data, implying high challenges on the computational infrastructure and framework as well as on the design of the data processing and analysis routines for the detectors.

We will review challenges and concepts in the implementation of the Transition Radiation Detector (TRD) in the ALICE-HLT. Limitations and advantages in a parallel software design for online and offline use will be discussed, concentrating on speed optimization and restrictions by the need for high precision offline routines. The versatility of the system will be demonstrated by introducing an HLT based TRD monitoring tool. The current status of the implementation and the strategy for first physics at the LHC will be presented.

HK 41.5 Tu 17:45 H-ZO 90

Analysis of ALICE - TRD test beam data — •Michael Kliemant for the ALICE-TRD-Collaboration — Johann Wolfgang Goethe-Universität, Frankfurt am Main, Deutschland

The Transition Radiation Detector (TRD) of the ALICE Experiment at the CERN-LHC is designed for high momentum electron identification in the central rapidity region. The measurement of electrons and positrons in Pb - Pb collisions is important for the analysis of quarkonia and heavy flavour production in the Quark Gluon Plasma (QGP). In November 2007 a test of one fully integrated TRD super module(final electronic and cooling set-up) at the CERN PS - accelerator with a mixed electron - pion beam (1, 2, 4 and 6 GeV/c) was performed. With this data set it is feasible to investigate the PID and tracking performance of the detector. The major aspect of this study is to improve the electron PID performance taking into account the correlations between the different detector layers due to Bremsstrahlung. Different PID - strategies will be discussed.

HK 41.6 Tu 18:00 H-ZO 90

Calibration of the ALICE Transition Radiation Detector with cosmic-ray data — •Bailhache Raphaelle for the ALICE-TRD-Collaboration — Institut für Kernphysik, Frankfurt, Deutschland

The ALICE Experiment is the dedicated heavy-ion experiment installed at the Large Hadron Collider (LHC). One of its detector systems, the Transition Radiation Detector (TRD), is a gas detector designed for electron identification and charged particle tracking. The charged particle ionizes the gas along its path and electrons drift in a uniform field of 700 V/cm over 3 cm before being amplified. We implemented procedures to calibrate the drift velocity of the electrons, the time-offset of the signal, the amplification factor and the width of the Pad Response Function (PDF) characterizing the sharing of the deposited charge over adjacent pads. The performances of the algorithms were tested on first real data taken with cosmic-rays in the ALICE setup. The calibration software was installed on the main ALICE data acquisition system at CERN and executed continuously during the cosmic-ray data taking in 2008, providing a first determination of the calibration constants. In this talk, we will discuss the implementation of the calibration software and the results obtained with the first four TRD supermodules installed in ALICE.

HK 41.7 Tu 18:15 H-ZO 90

Feasibility study on determining the effective radiation thickness of the Transition Radiation Detector of ALICE from PS data with a beam of tagged electrons and pions — •Robert Grajcarek for the ALICE-TRD-Collaboration — University of Heidelberg

The Transition Radiation Detector (TRD) of the ALICE experiment at LHC identifies electrons with momenta above 1 GeV/c and provides fast (6 μs) triggering capability for high transverse momentum charged particles ($p_T > 3$ GeV/c). The effective radiation thickness serves as an essential input for physics analyses relying on detailed Monte Carlo detector performance studies. When electrons cross matter, they are subject to energy loss due to Bremsstrahlung. By measuring the energy distribution of electrons after traversing the TRD, it is in principle possible to determine the effective radiation thickness. We report recent results from a testbeam at the Proton Synchroton at CERN (PS) with tagged electrons and pions impinging on one of the eighteen supermodules of the TRD in its final configuration. Beam momenta with 0.3, 0.6, 1.0, 1.5, 2.0, 3.0, 4.0 and 6.0 GeV/c were used. The resulting electron energy has been measured by a lead-glass cherenkov calorimeter. In order to fully decribe the data, detailed Monte Carlo

simulations were performed, including all relevant details of the experimental setup.

HK 41.8 Tu 18:30 H-ZO 90

Alignment of ALICE TRD Modules Using Cosmic Rays — •Eva Sicking for the ALICE-TRD-Collaboration — Institut für Kernphysik, WWU Münster

The Transition Radiation Detector (TRD) is a central component of the heavy ion collider experiment ALICE at the LHC. The cylindrical detector consists of 18 super modules, which undergo final assembly in Münster. One super module contains 30 independent detector chambers. As part of the assembly process tracks of cosmic rays are recorded and reconstructed to perform a first calibration pass.
Due to limited accuracy during assembly the real position of the chambers can differ from their positions in the ideal geometry. To provide a high position resolution and thus a high resolution in transverse momentum, the geometry has to be corrected for these displacements.
We will present a first determination of these displacements using straight tracks of cosmic rays. These results allow for a survey of the chamber positioning during super module assembly and will be used during reconstruction.

HK 41.9 Tu 18:45 H-ZO 90

ALICE HLT Tracking — •Sergey Gorbunov for the ALICE-HLT-Collaboration — Kirchhoff-Institut für Physik, Heidelberg, Germany

A fast tracking algorithm has been developed for ALICE High Level Trigger. The algorithm reconstructs all kinds of data including physics p-p and Pb-Pb events, cosmics and laser calibration events. For the pattern recognition a Cellular Automaton method is used, while the track fit is performed with a Kalman filter. The algorithm shows high quality and speed. It performs all the calculations in parallel which allows one to use fast multiprocessor hardware for the HLT event reconstruction, thus increasing the speed of data processing by an order of magnitude. The reconstruction efficiency for heavy ion events is ˜96% and the speed is 1300 ms/event on a current CPU and only 140 ms/event on a modern GPU card. The algorithm is intended for on-line data processing in the High Level Trigger of the ALICE experiment.